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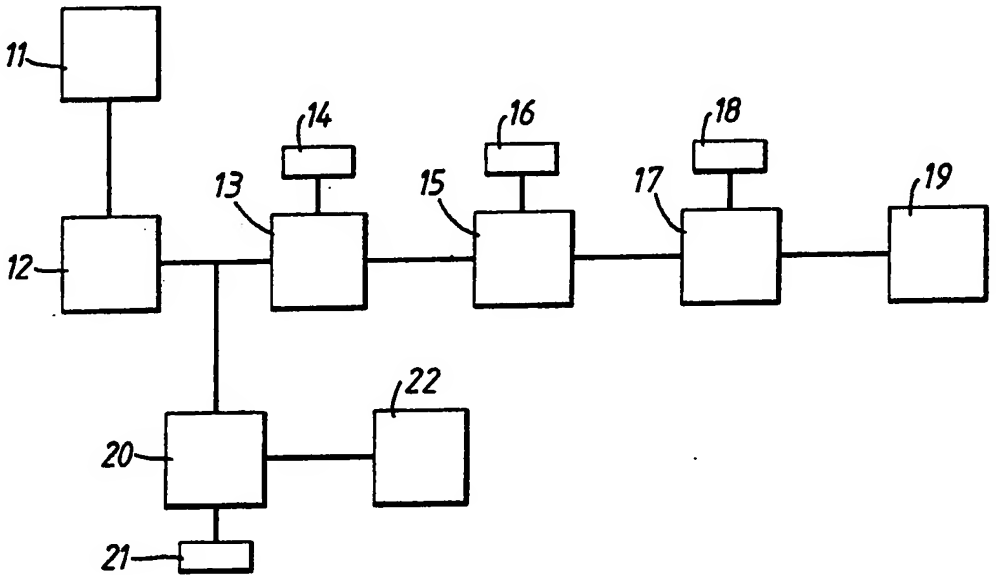

(57) Abstract

The disclosure relates to a dream machine, arranged to awake a sleeper experiencing a dream. In one embodiment a physical condition of the sleeper is monitored by a sensor (11), the sensed physical condition is compared with a predetermined value for the physical condition and when the monitored value of the physical condition reaches the predetermined value an alarm (19) wakes the sleeper. In one form the predetermined value is set manually but in other arrangements said value is calculated in the machine.

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"DREAM MACHINE"

This invention relates to a dream machine and, more specifically, to a machine arranged to awake a sleeper experiencing a dream at a predetermined point in the dream to afford the dreamer recall of the dream.

In a normal sleep period a sleeper will experience alternating periods of "slow wave sleep" (SWS) and so-called "rapid eye movement" sleep (REM). The periods of SWS may vary from a few minutes to an hour, and the REM sleep periods can vary from a few minutes to forty minutes or, in exceptional cases, longer.

Generally the longer periods of SWS will occur in the early part of the sleep period and the length of the periods reduce as the sleep period continues whilst the shorter periods of REM sleep occur in the early part of the sleep period and the length of said periods increases as the sleep period continues.

It has been estimated that in an eight hour sleep period the average adult can experience some two hours of REM

sleep periods. It has also been estimated that at least ninety five percent of all vividly recalled dreams occurred in the REM sleep period. There are detectable changes between SWS and REM sleep periods and, for example, there is a readily detectable difference in the breathing rate.
It is well known in the art that the higher the respiration rate in a dream the more vivid will be the recall of the dream.

A sleeper's ability to recall a dream is dependent upon the point at which the sleeper awakes. If the sleeper awakes in a REM period in which the sleeper is experiencing a dream he, or she, will have immediate and vivid recall of the dream.

Whilst the most vivid recall of a dream occurs when the sleeper is woken whilst in the dream state the ability to recall a dream does not necessarily terminate if the sleeper remains asleep beyond the end of the dream, the ability to recall a dream does fade rapidly at the end of the dream phase but, if awakened after the breathing rate having risen above the predetermined rate and falls to the said predetermined breathing rate, or up to two or three minutes after the monitored breathing rate has fallen below the predetermined breathing rate the sleeper can have some recall of the dream and the closer to the end of the dream phase the sleeper awakes the more vivid is the recall of the dream.

The present invention seeks to provide a dream machine, arranged to detect a dream phase in sleep and to wake the dreamer at a predeterminable point in the dream to afford the dreamer recall of the dream.

According to the present invention there is provided a dream machine, comprising means for detecting a dream state and means for waking the sleeper at a predetermined time directly related to the dream state.

Preferably said means for detecting a dream state comprise means for monitoring at least one physical condition of the sleeper known to vary between slow wave sleep periods

and rapid eye movement sleep periods. Physical conditions which do vary between slow wave sleep periods and rapid eye movement periods, and which can be readily monitored are, for example, heart or pulse beat, eye movement, twitching of digits and or breathing rate

Preferably said means for detecting a dream state comprise means for monitoring breathing rate. For most adults the respiration rate in SWS is in the region of twelve to fourteen cycles per minute whilst in REM sleep the breathing rate increases and can exceed thirty cycles per minute.

Preferably said means for detecting a dream state comprise means for detecting changes in the monitored physical condition.

Preferably said machine includes comparator means, arranged to compare the monitored physical condition with a predetermined value of the physical condition.

In one embodiment in accordance with the invention the machine includes means for monitoring the physical condition being monitored over a predetermined time period, determining the maximum value of the monitored physical condition over said predetermined time period, and storing said maximum value as the predetermined value of the physical condition for comparison by the said comparator means.

In another embodiment the machine includes means for monitoring the physical condition being monitored over a predetermined time period, determining an average value for the physical condition being monitored over the said predetermined time period, adding to the said average value a preset value to obtain the said predetermined value of the physical condition, and storing said predetermined value of the physical condition for comparison by said comparator means.

In a further embodiment the machine includes means for manually setting the said predetermined value of the physical condition for comparison by said comparator means.

Preferably the machine is characterised by an alarm and means for actuating said alarm when the comparator means

detects a value of the monitored physical condition equal to the said predetermined value of the physical condition.

Preferably the alarm comprises a stepped audible alarm which increases in volume one a predetermined time period.

In another embodiment the machine is characterised by an alarm and means for actuating said alarm a predetermined time period after the value of the monitored physical condition has reached the said predetermined value of the physical condition.

Preferably the machine is characterised by a first timer, means for starting said first timer when the comparator means detects a value of the monitored physical condition equal to the said predetermined value of the physical condition, and means controlled by said short timer for actuating said alarm when said short timer has run for a predetermined time period.

In one embodiment the timer is arranged to return to its start or zero position, without actuating the said means for actuating the alarm, if the monitored physical condition falls below said predetermined value of the physical condition whilst the timer is running.

In another embodiment the machine is characterised by an alarm, arranged to be actuated only when the monitored physical condition has risen above the said predetermined value of the physical condition condition and falls to said predetermined value.

Preferably the machine is characterised by a long timer, arranged to run for a predetermined time period, and arranged to prevent the said means for waking the sleeper from being actuated whilst the said long timer is running.

In a preferred embodiment the machine is characterised by an alarm, arranged to actuate immediately the detected physical condition reaches a predetermined value of the physical condition.

In one embodiment in accordance with the invention the machine is characterised by means for detecting a dream state and means for transmitting a signal to the sleeper,

recognisable by the sleeper as indicative of a dream state, before the means for waking the sleeper are actuated.

Preferably the said signal comprises a series of pulses applied to the sleeper.

The invention will now be described further by way of example with reference to the accompanying drawings in which

Fig. 1 shows, in blocked diagram form, one arrangement for a dream machine in accordance with the invention and

Fig. 2 shows, diagrammatically and in block form, a dream machine in accordance with the invention being capable of operating in different ways.

In the example illustrated in Fig. 1 a means for monitoring a physical condition of the sleeper comprises a sensor 11, which in this embodiment conveniently comprises a temperature sensitive element, is arranged in or adjacent an air duct of a sleeper to detect the differences in temperature as the sleeper inhales and exhales. A monitoring means 12, is arranged to receive signals indicative of the changes of temperature from the sensor 11 and is adapted to extend a signal indicative of the breathing rate of the sleeper to a comparator device 13. The comparator device 13 includes a manual control 14 by which a signal indicative of a predetermined breathing rate can be stored in the comparator 13.

The comparator device 13 compares the signals received from monitoring means 12 with the stored predetermined breathing rate signals and, when the said monitored breathing rate from monitoring means 12 rises above the stored predetermined breathing rate the comparator device 13 extends an actuating signal to a short timer 15. The short timer 15 has a manual control 16 by which the time period for the short timer 15 can be adjusted to run and, conveniently, the short

timer 15 may be manually set to run for any desired period between one and fifteen minutes.

When the signal from comparator 13 to short timer 15 is maintained for the time period set for timer 15, the short timer 15, extends a signal to a long timer 17, and which may be manually adjusted to run for a period up to eight hours by a manual control 18.

In the event that the actuating signal from comparator 13 to timer 15 is terminated before timer 15 runs out, due to the breathing rate detected by the monitoring means 12 falling below the predetermined breathing rate stored in the comparator 13, the short timer 15 returns to zero and does not extend a signal to the long timer 17.

The signal from the timer 15 to timer 17 is blocked whilst the timer 17 is running and is extended to an alarm 19, conveniently a stepped audible alarm increases in volume in time, only after the time period set by the timer 17 has run out.

The monitored breathing rate from device 12 is also extended to a comparator device, 20 which stores a predetermined breathing rate which may be adjusted by a manual adjustment 21, the predetermined value set for the comparator 20 is higher than that set for the comparator device 13 and whereupon, on the monitored breathing rate from the device 12 reaching the predetermined value set in the comparator 20 the comparator 20 immediately actuates a second alarm 22, which again may comprise a stepped audible alarm which increases in volume with time.

It should be observed that the signals from the comparator 20 to the alarm 22 bypass the long timer so that the alarm 22 can be actuated at any time during the sleep period.

To prepare the device for use the intended sleeper will first set the timer 17 to a predetermined time period to allow the sleeper to enjoy an uninterrupted sleep for the period set on said timer 17, the short timer 15 will then be set to determine the length of dream from which the sleeper

wishes recall and the predetermined breathing rate for triggering the comparator 13 is then set, conveniently between 17 and 22 breathing cycles per minute dependent upon the level of emotion the sleeper wishes to experience. The sleeper will then set, using the control 21, a predetermined breathing rate above that set for the device 13, and which conveniently may lie above 28 breathing cycles per minute. It is then only necessary for the sleeper to retire and to fit the sensor 11 in one nostril, preferably using a clip which will not cause the sleeper discomfort.

Whilst the sleeper is asleep the sensor 11 is continuously monitoring the temperature change between inhalation and exhalation and the monitoring device 12 is transmitting a signal to the comparator device 13 and to the comparator device 20 indicative of the breathing rate of the sleeper.

In the event that at any time during the sleep period the monitored breathing rate rises above the preset value for the comparator 20, indicative of an unpleasant dream or a nightmare, the comparator device 20 immediately actuates the alarm 22 which emits an audible alarm at a relatively low level. If the low level alarm is sufficient to disturb the sleeper from the unpleasant dream or nightmare the monitored breathing rate will fall below the predetermined level set in the comparator 20 and on such a fall below said predetermined value the signal to the alarm is terminated. In the event that the low level alarm does not disturb the sleeper and the unpleasant dream or nightmare continues the alarm 22 goes to its higher level of sound to wake the dreamer from the unpleasant dream or sleep thus to terminate the unpleasant dream or nightmare before said dream can become too fearful.

In the event that the monitored breathing rate rises above the predetermined level set for the comparator 13, to cause short timer 15 to start running signals from the timer 15 to the long timer 17 are blocked until the timer 17 has run out, thus allowing the sleeper to enjoy an undisturbed sleep

period, but with the timer 17 run out a signal to timer 15 from the comparator 13 of sufficient length to allow the timer 15 to run out will cause the alarm 19 to be actuated to awake the sleeper and, with the sleeper awakening from the dream he or she will have full recall of the dream.

Thus, the device illustrated in Fig. 1 allows the sleeper to enjoy an undisturbed period of sleep whilst timer 17 is running and arouses the sleeper from any dream period after the timer 17 has run out and which dream runs longer than the period set in the timer 15. Further, the sleeper can feel confident that the comparator 20 will, throughout the sleep period, prevent the sleeper from experiencing an unpleasant dream or nightmare.

In the example illustrated in Fig. 2 sensor 31, conveniently a temperature sensing device located in or adjacent the breathing duct of the sleeper, determines temperature changes between inhaling and exhaling of the sleeper and transmits this information to a monitoring means 32. The monitoring means 32 receives the signals from sensor 31 and, by monitoring said signals relative to an inbuilt timer, extends a signal indicative of the monitored breathing rate to a comparator device 33 and to a smoothing device 34, which counts the number of breathing cycles indicated by the signals from monitor 32, over a period of time, calculates a mean value for the breathing rate and extends a signal indicative of the mean breathing rate over said predetermined period to a memory 35.

On receiving signals indicative of the monitored breathing rate from the device 32 and the stored mean breathing rate from the memory 35 the comparator device 33 compares said values and, when the monitored breathing rate from the device 32 exceeds the stored breathing rate from the device 34 by a predetermined amount the comparator device 33 emits a transmission signal which may be used in one of three modes

In one mode, indicated in full line in Fig. 2, the comparator device 33 emits an activating signal to a short

timer 36, set to run for a predetermined time (1 to 15 minutes) and which may be manually set by means (not shown), or which may be preset in the machine.

The comparator device 33 will continue to emit its transmission signal to the shirt timer 36 whilst the monitored breathing rate value from the device 32 continues to exceed the stored valve from the device and if the transmission signal from comparator device 33 terminates before the timer 36 has run through its time period the short timer 36 is re-set to zero.

In the event that the comparator device 33 continues to transmit its signal to the timer 36 until the timer 36 runs out a signal is extended to a long timer 37, which may be pre-set for a predetermined time period or manually adjustable to a predetermined time period, the long timer 37 runs continuously from its actuation and if a signal from timer 36 is received by timer 37 before the timer 37 has run through its preset time period the timer 37 blocks the signal from the timer 36 and the timer 36 then returns to its start position.

In the event that the signal from timer 36 is received by timer 37 after the predetermined time period set for said timer 37 the timer 37 extends a signal to an alarm 38, conveniently a stepped audible alarm which increases in volume with time, to awake the sleeper.

In its second mode for operation, indicated by the dotted line in Fig. 2, the comparator 33, on detecting a monitored breathing rate above the value stored in memory 35, extends a signal to the timer 37 and, if the timer 37 has run through its preset time period, a signal is extended to the audible alarm 38.

In its third mode of operation (indicated by the broken line in Fig. 2) the comparator device 33 on receiving a monitored breathing valve exceeding the stored breathing valve, transmits a signal to the long timer 37 to actuate the alarm 38 only when the comparator 33 detects the monitored breathing rate falling below the predetermined value, indicative of the

end of a dream, whereupon the sleeper is woken immediately after the dream has terminated.

The device illustrated in Fig. 2 also includes a comparator device 39, pre-setable by a manual control 38, and arranged to operate in identical manner to the comparator device 20 and control 21 illustrated in Fig. 1 and, when actuated, the comparator device 39 is arranged to emit a signal to actuate an alarm 40, arranged to operate in identical manner to the alarm 22.

It will now be appreciated that in all the above described modes of operation the apparatus continuously monitors a physical condition (in the embodiments the breathing rate) of the sleeper, compares the monitored physical condition with a predetermined value of the physical condition which may be manually set or determined by the apparatus and, when the monitored physical condition exceeds the predetermined value of the physical condition, wakes the sleeper during, or immediately after, the detected dream state to afford the sleeper full and vivid recall of the dream.

CLAIMS

1. A dream machine, comprising means for detecting a dream state and means for waking the sleeper at a predetermined time directly related to the dream state.

2. A dream machine according to claim 1, characterised in that said means for detecting a dream state comprise means for monitoring at least one physical condition of the sleeper known to vary between slow wave sleep periods and rapid eye movement sleep periods.

3. A dream machine according to claims 1 or 2, characterised in that said means for detecting a dream state comprise means for monitoring breathing rate.

4. A dream machine according to claim 2 or 3, characterised in that said means for detecting a dream state comprise means for detecting changes in the monitored physical condition .

5. A dream machine according to claim 4 characterised by comparator means arranged to compare the monitored physical condition with a predetermined value of the physical condition.

6. A dream machine according to claim 5, characterised by means for monitoring the physical condition being monitored over a predetermined time period, determining the maximum value of the monitored physical condition over said predetermined time period, and storing said maximum value as the predetermined value of the physical condition for comparison by the said comparator device.

7. A dream machine according to claim 5, characterised by means for monitoring the physical condition being monitored over a predetermined time period, determining an average value for the physical condition being monitored over the said predetermined time period, adding to the said average value a preset value to obtain the said predetermined value of the physical condition, and storing said predetermined value of the physical condition for comparison by said comparator means.

8. A dream machine according to claim 5, characterised by means for manually setting the said predetermined value of the physical condition for comparison by said comparator means.

9. A dream machine according to claim 5, 6, 7 or 8, characterised by an alarm and means for actuating said alarm when the comparator means detects a value of the monitored physical condition equal to the said predetermined value of the physical condition.

10. A dream machine according to claim 5, 6, 7 or 8, characterised by an alarm and means for actuating said alarm a predetermined time period after the value of the monitored physical condition has reached the said predetermined value of the physical condition.

11. A dream machine according to claim 10, characterised by a first timer, means for starting said first timer when the comparator means detects a value of the monitored physical condition equal to the said predetermined value of the physical condition, and means controlled by said short timer for actuating said alarm when said short timer has run for a predetermined time period.

12. A dream machine according to claim 11, characterised in that the timer is arranged to return to its start or zero position, without actuating the said means for actuating the alarm, if the monitored physical condition falls below said predetermined value of the physical condition whilst the timer is running.

13. A dream machine according to claim 5, 6, 7 or 8, characterised by an alarm, arranged to be actuated only when the monitored physical condition has risen above the said predetermined value of the physical condition condition and falls to said predetermined value.

14. A dream machine according to any of the preceding claims characterised by a long timer, arranged to run for a predetermined time period, and arranged to prevent the said means for waking the sleeper from being actuated whilst the said long timer is running.

15. A dream machine according to any one of claims 2 to 14 inclusive characterised by an alarm, arranged to actuate immediately the detected physical condition reaches a predetermined value of the physical condition.

16. A dream machine according to any of the preceding claims characterised by means for detecting a dream state and means for transmitting a signal to the sleeper, recognisable by the sleeper as indicative of a dream state, before the means for waking the sleeper are actuated.

17. A dream machine according to claim 16, characterised in that the said signal comprises a series of pulses applied to the sleeper.

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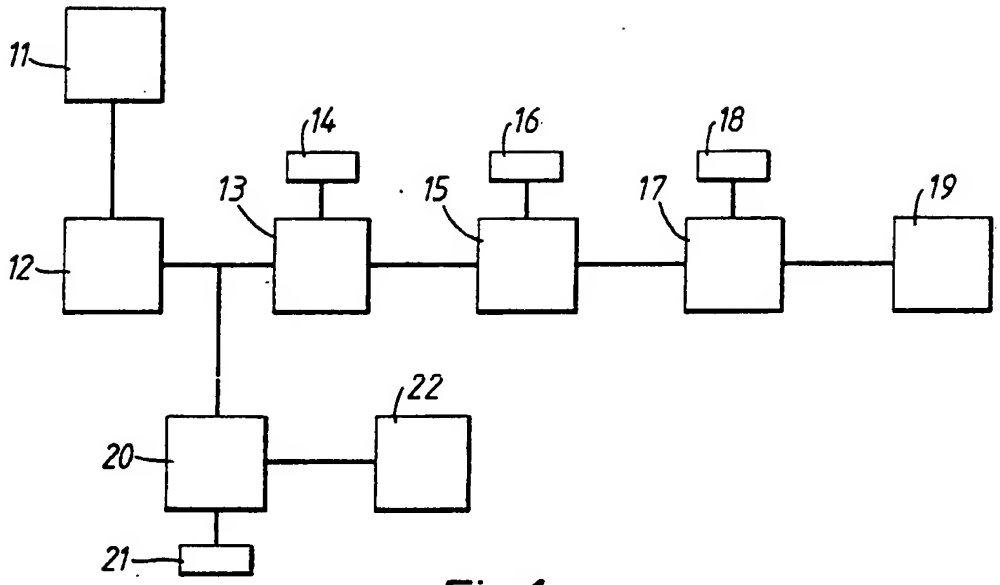

Fig.1.

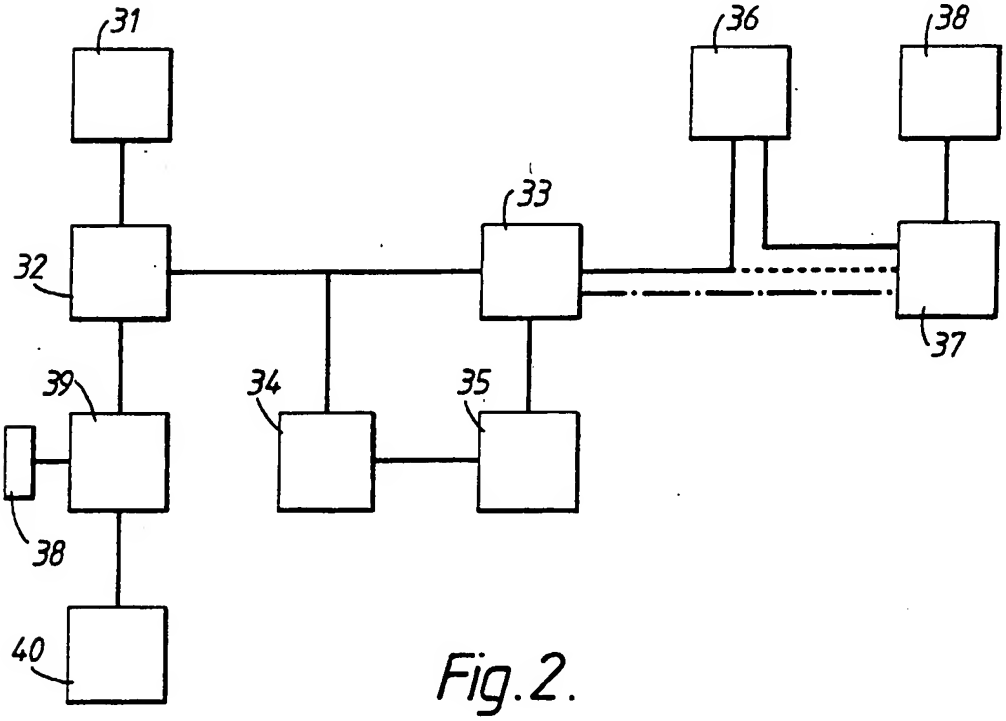

Fig.2.

INTERNATIONAL SEARCH REPORT

PCT/GB 91/00743

International Application No.

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 A61B5/08

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	A61B

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	US,A,4420001 (K.M.T. HEARNE) 13 December 1983 see column 2, line 42 - column 4, line 24	1-5, 8-14, 16
A	US,A,3802417 (V. LANG) 09 April 1974 see column 3, lines 38 - 53; figures see column 5, line 4 - column 7, line 13	1-5, 8-14
A	US,A,4715367 (R.B. CROSSLEY) 29 December 1987 see column 7, line 15 - column 8, line 16	1-5, 8-10, 17
A	MEDICAL AND BIOLOGICAL ENGINEERING AND COMPUTING. vol. 21, no. 5, September 1893, STEVENAGE GB pages 632 - 635; J. Peirick et al.: "Automated apnoea detection by computer: analysis of tracheal breath sounds" see page 633, section 2.3 "Computer software"	2-6

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° Special categories of cited documents :[10]

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 JULY 1991	14.08.91
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	RIEB K.D.

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	IEEE Proceedings of the 12th Annual Northeast Bioengineering Conference 14 March 1986, New York (US) pages 51 - 54; M.L. Kejariwal et al.: "Microprocessor-Based Home Monitor for SID Syndrome" see page 54, Section "Microprocessor Software" ---	5-7, 9-11, 13-15

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. GB 9100743

SA 47456

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 24/07/91
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4420001	13-12-83	None		
US-A-3802417	09-04-74	DE-A,B	1816783	09-07-70
		DE-A-	2107098	24-08-72
		FR-A,B	2125449	29-09-72
		GB-A-	1356212	12-06-74
		SE-B-	382378	02-02-76
		SE-A-	7502250	27-02-75
		DE-A-	2107099	24-08-72
US-A-4715367	29-12-87	None		

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DOCUMENT-IDENTIFIER: WO 9116853 A1
TITLE: DREAM MACHINE
PUBN-DATE: November 14, 1991

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EUR-CL (EPC): A61B005/08

US-CL-CURRENT: 600/534 , 600/537

ABSTRACT:

CHG DATE=19990617 STATUS=O>The disclosure

relates to a dream machine, arranged to awake a sleeper experiencing a dream. In one embodiment a physical condition of the sleeper is monitored by a sensor (11), the sensed physical condition is compared with a predetermined value for the physical condition and when the monitored value of the physical condition reaches the predetermined value an alarm (19) wakes the sleeper. In one form the predetermined value is set manually but in other arrangements said value is calculated in the machine.